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FEDORENKO OUTLINES NEW ECONOMIC PROGRAMS

Development of Economic Science

Moscow LITERATURNAYA GAZETA in Russian No 11, 11 Mar 81 pp 10-11

[Interview with N. P. Fedorenko, academician, academic secretary of the Department of Economics of the USSR Academy of Sciences, director of the Central Economic and Mathematical Institute of the USSR Academy of Sciences, by B. Smagin, correspondent of LITERATURNAYA GAZETA: "Economic Levers of Progress"; date and place not specified]

[Text] "The problems posed by life require the development of the theory of economic science and bringing it closer to the needs of economic practice," states the report by Comrade L. I. Brezhnev at the 26th CPSU Congress. This thought found interested support in the speeches by delegates to the party forum and was included in detailed and expanded form in the "Basic Trends in the Economic and Social Development of the USSR for 1981-1985 and for the Period Until 1990." What is specifically done today in the area of Soviet economic science? N. P. Fedorenko, academician, academic secretary of the Department of Economics of the USSR Academy of Sciences, director of the Central Economic and Mathematical Institute of the USSR Academy of Sciences, discusses this in his talk with B. Smagin, correspondent of LITERATURNAYA GAZETA.

[Question] Nikolay Prokof'yevich, our first question pertains to the department's activity in the last 5 years, that is, during the period between two party congresses. What can be said about our economic science? How did it develop during that period?

[Answer] I would like to begin with Leonid Il'ich Brezhnev's words from his report at the 26th party congress: "Evaluating the traversed path, it can be stated firmly: The 25th congress correctly determined the basic tendencies and trends in social development... On the whole, the problems posed at the previous congress were solved successfully." I believe that this evaluation can be applied not only to our country's economy, but to economic science as well.

Economic scientists strove to fulfill party assignments and helped to improve planning and economic work in the country. A large collective in cooperation with the representatives of many other sciences, engineers and technicians prepared an overall program for scientific and technical progress and its social and economic consequences for the period until 1995-2000. It provided guidelines for the elaboration of the basic trends in the country's social and economic development for the next 5-year period and until 1990.

The development of an overall program for scientific and technical progress is applied work. However, it is also of great theoretical importance and in many respects is based on studies conducted by the scientific research collectives of the USSR Academy of Sciences.

The department's scientists also engaged in six fundamental research programs. I will not enumerate them now specifically, or analyze the results. I will only say that the scientific activity of scientists encompassed all the problems of our economy without exception, that is, from the problems of construction of the material and technical base of communism and the scientific and technical revolution to practical steps--participation in the development of the automated planned calculation system of the USSR State Planning Committee and the state planning committees of the Union republics.

I consider the investigation of the problems of economics of nature utilization an exceptionally promising trend. In fact, a new scientific discipline--ecological economics--is now being formed. The plan for the standard method of evaluation of mineral resources has already been developed. Apparently, it will soon be put into effect, because its experimental check has been completed.

Finally, another forward step in the solution of the important problem of determination of the economic efficiency of new equipment has been taken. Again, a method has been developed and is now used in all national economic sectors.

Important research on demography, in which economists took an active part, was conducted within the routine overall program. The readers of LITERATURNAYA GAZETA, who have only recently completed a big discussion of the problem of personnel shortage, visualize the importance of this problem under present conditions, especially if we take into consideration that, obviously, the situation will be aggravated during the 11th and 12th Five-Year Plans.

A new long-term plan for the development and distribution of the country's national economy has been worked out. Its basic principles ensure a fuller utilization of fuel-power and other natural resources and a more harmonious development of the country's economic regions. The far-reaching Sibir' program developed by Siberian economic scientists joins the regional economic program. There is no doubt that it has a big future. The scientists of the Department of Economics together with the Siberian Department of the USSR Academy of Sciences will take part in its further development and realization.

Finally, scientists are occupied with the foreign economy and the country's foreign economic relations and seek to study the positive experience of the fraternal socialist countries, as well as the experience in economic management, if it is

applicable to our system, accumulated in developed capitalist countries. The new approach gives very positive results at a number sections of our socialist construction.

"Politicheskaya Ekonomiya" [Political Economy], an economic encyclopedia in four volumes, and a number of big monographs and reference tools were published.

[Question] The past years are significant for the new approach to economic science--its mathematization. Is this process continuing? What characterizes it? What practical use does it find?

[Answer] Generally speaking, the mathematization of economic science is no longer such a new process. All the prominent economists of the past tried to use mathematical methods during an analysis of economic phenomena. According to Lafargue's testimony, K. Marx maintained that science achieves perfection only when it is able to use mathematics.

Economic theory studies complex social phenomena. It is clear that numerous questions concerning the rates and proportion of the national economy can be answered only in a qualitative way. Quantitative data and a comparison of specific variants are mandatory. Here is a simple example: The more is spent on consumption, the less remains for capital investments and vice versa. Not having an optimal strategy of accumulation calculated by mathematical methods, we run the risk of either, out of concern for an increase in current consumption, inflicting serious damage on future generations, or, thinking only about the future, hampering without substantiation the present development of the sectors of group B and the nonproduction sphere.

An ever wider mass of workers in economic science and practice use economic and mathematical methods. A vast economic and mathematical literature--from popular to highly specialized--and the journal *EKONOMIKA I MATEMATICHESKIYE METODY* are published. Specialists are trained in higher educational institutions. Of course, as yet not all obstacles have been overcome and the psychological barrier often encountered by innovations also manifests itself in this area. We must create economic conditions in the country under which, in L. I. Brezhnev's words, enterprises and organizations do not avoid innovations as the devil avoids holy water, but seek and chase after them. Therefore, we must try to eliminate some obsolete planning indicators and other imperfect elements of the economic mechanism, which hamper such an important matter.

[Question] What is now the role of the new methods? What place do they hold in the general system of planning in our country?

[Answer] Very likely, the sectorial level of planning has been mastered best of all. Here the solution of economic and mathematical problems, in particular problems of distribution and development of production, can be put, so to speak, on the conveyor belt. Numerous scientific research and design institutes widely use these methods and their application gives a real saving of many millions. Suffice it to cite the following example: The solution of one problem in the long-term siting of enterprises of the petroleum refining industry will make it possible to meet the country's needs for its products with an expenditure of several hundreds

of millions of rubles of capital investments less than according to a traditionally developed plan. Thus, research work, in which only a few dozen people--economists, mathematicians and programmers--participated, justified the existence of such a big institute as the Central Economic and Mathematical Institute for many decades to come.

Economic and mathematical methods are also used in the planning of the work of enterprises within the framework of automated control systems. Here we are not yet fully satisfied with the results. Most of the automated control systems are engaged only in the simplest problems, basically of the nature of information, whereas it is necessary to deal with more complex problems of economic and mathematical optimization of production, which produces a substantial effect. The scientific apparatus has been developed--it must be introduced.

[Question] An extensive utilization of overall object programs has been discussed in the decisions of the 26th party congress. Please tell us about them at greater length. How and where are they used? What are their advantages?

[Answer] The modern methodology of object planning--one of the areas of economic and mathematical modeling--has developed rapidly in the last few years. Object program methods make it possible to increase the coordination of numerous collectives participating in the solution of both major problems of statewide significance and of relatively individual problems; for example, the mastering of new products at some enterprises. Methods of object program planning are used especially widely during the development and mastering of new territorial industrial complexes. Dozens of major scientific and technical programs, which combine the efforts of collectives of enterprises and scientific and planning institutions of many ministries and departments, have been developed and are realized under the guidance of the Committee for Science and Technology. Furthermore, every sector has its own set of sectorial object programs and is engaged in their realization.

[Question] What, in your opinion, are the subsequent ways of development of economic science and practice in our country? What do you expect in the near and distant future?

[Answer] Economic scientists in our department have developed a plan for scientific research on key economic problems. For example, further work has been envisaged both in the area of study of economic and social problems of developed socialism and of the patterns in its development into communism and problems of the theory and methodology of planning and management of the socialist economy, as well as problems of development of the world economy.

I will not reveal any secret if I say that eliminating the shortcomings still existing in our economic mechanism and overcoming the negative tendencies in the development of the economy, which were discussed with right-mindedness at the latest plenums of the CPSU Central Committee and the 26th party congress, largely depend on economic science. On the basis of this we become more and more convinced that it is necessary to develop a unified long-term program for improving the planning and management of our economy. A special body responsible for the development and realization of this plan must be established at the highest level.

The long-term program is conceived as exceptionally mobile. It is difficult to overestimate its importance in the matter of increase in the efficiency of management. It should uncover the vast reserves of labor and raw material resources, reserves of a vast production potential, which as yet are by no means utilized with full force.

Economists should also more profoundly work out the problem of the social goals of economic development and the ways of attaining these goals. For example, it is a matter of solving problems of coverage of the population's effective demand, price formation and rationalization of consumption and of investigating problems of distribution of sources of income formation, the structure of this income and its distribution among social population groups, national economic sectors and the country's territory. All this should be considered from the standpoint of the principle of distribution according to the results of labor and, at the same time, from the standpoint of the solution of a large number of social problems (elimination of inadequate financial security and improvement in the conditions for the reproduction of the population, retention of personnel, increase in the employment of pensioners and so forth).

In general, problems of employment represent an extremely urgent topic. The prospects for the development of the population's private property, including private subsidiary plots, also attract considerable public attention. Any extremes are dangerous. However, I must admit that as yet there are no political and economic substantiations for the prospects for the development of private forms of property and this task is one of the most urgent.

Problems of refinement of planning and forecasting, improvement in the rates and proportions of our national economic development, retooling of the country's production apparatus, saving of production resources, development of cost accounting and improvement in the levers of economic management—all this must constantly be in the zone of our attention.

Lastly, it is obvious that the final results of work of economic scientists depend not only on them, but on the utilization of the achievements of economic science at all the levels of planning and management of the national economy. In particular, one would wish that the role of the Council for the Examination of Major Social and Economic Problems, Long-Term Plans and Results of Research in Economic Sciences of the USSR State Planning Committee in the performance of economic experiments becomes more noticeable. In our opinion, it is necessary to organize under economic institutes, where this is possible, cost accounting consultative centers directly interested in the use of research results in practice. It seems that the problem of realization of a system of measures, which would equally encourage economists, planning workers and managers to more energetically introduce all the valuable innovations developed by economic science into the practice of communist construction and thereby to contribute to a successful accomplishment of the pressing tasks connected with raising the standard of living of the workers of our homeland, has become urgent.

Tasks of Economic Science

Moscow EKONOMICHESKAYA GAZETA in Russian No 16, Apr 81 p 10

[Article by N. Fedorenko, academician: "Economic Science and Practice"]

[Text] The increasing importance of both fundamental research and applied studies is the most characteristic feature of the development of economic science under present conditions. Profound theoretical generalizations and substantiated recommendations of economists are needed for a successful solution of large-scale problems in economic construction, rise in the people's well-being, transfer of the economy to an intensive path of development and overall introduction of new methods of management. "The problems posed by life," L. I. Brezhnev stressed in his report at the 26th CPSU Congress, "require the development of the theory of economic science and bringing it closer to the needs of economic practice."

Research Program

The accountability report of the CPSU Central Committee to the party congress is a document of great theoretical and practical importance. The creative development of Marxism-Leninism is combined in it with the formulation of the urgent tasks facing the Soviet people and with a profound analysis of the prospects for social development.

The tasks of economic science in the light of the decisions of the 26th party congress and the ways of their realization were thoroughly discussed by economic scientists at the annual meeting of the Department of Economics of the USSR Academy of Sciences. The basic trends in the work of the department's academic institutions were approved. They envisage the concentration of efforts on the development of six overall subjects for the further investigation of problems of the economy of developed socialism and its development into communism, planned management of the economy, increase in the efficiency and intensification of production, regional development of the USSR and formation of large national economic complexes, as well as problems of the world socialist economy, the economy of capitalist countries and foreign economic relations.

Economic investigations should be directed to an even greater extent toward ensuring a stable, progressive growth of the national economy, acceleration of scientific and technical progress and increase in production efficiency. This requires an outstripping development of fundamental research and an increase in the efficiency of applied research.

The congress noted that extensive work has been done in the area of social sciences and it deserves recognition. However, by no means everything is satisfactory. The accountability report of the CPSU Central Committee stressed that many problems awaiting their solution accumulated in the political economy of socialism.

Economic scientists conducting investigations in the theoretical problems of the economy of developed socialism, establishment of the material and technical base of communism and improvement in production relations face the task of more profoundly and thoroughly disclosing the patterns in the stage of developed socialism--this, as L. I. Brezhnev stressed, necessary, natural and historically long

period in the formation of the communist system. Economic science must conduct more profound and specific investigations of the mechanism of realization of the advantages and increased capabilities of the socialist economic system.

An analysis of the social consequences of the scientific and technical revolution is of great theoretical and practical importance. It is necessary to more profoundly investigate the changes in the content and nature of labor and the ways of overcoming social and economic differences in labor.

The importance of investigations of the economic aspects of demographic processes in the country and its individual regions increases under present conditions. This will make it possible to raise the scientific level of recommendations for the implementation of an efficient demographic policy.

Intensification of the Efficiency of Science

During the current five-year plan the development of science should be subjected to an ever greater extent to the solution of the economic and social problems of Soviet society, acceleration of the transfer of the economy to the path of intensive development and increase in the efficiency of public production.

The development and realization of an overall program for scientific and technical progress, as well as object programs for the solution of the most important scientific and technical problems, and intensification of mutual relations between science and production are among the most important tasks of science.

The department's institutes will also have to continue the investigations of the ways of a dynamic and balanced development of the economy as a single national economic complex, long-term social needs and the social and economic goals of long-term development. This requires the development and concretization of the concept of the socialist way of life in all its aspects--material well-being, spiritual development, distribution relations, conditions of increase in labor efficiency and demographic policy.

Work on the substantiation of an overall program for scientific and technical progress for 20 years, development of its social and economic aspects and formation and concretization of object programs of national economic importance (food, power and a number of others) will have to be continued intensively. For the purpose of further improving the system of planning, management and organization of the national economy special attention should be given to the development and introduction of efficient systems of economic and mathematical models into planning practice.

When determining research subjects, their trends and periods and the possibilities of their practical utilization, it is important to take into account the interests and "order" of central economic bodies and departments, to strengthen contacts with them and to participate in the development of programs and in an analysis of the results of experiments conducted by them.

Coordination of the efforts of academic, sectorial and university science, scientists and practical workers will make it possible to successfully solve the urgent problems of economic theory and practice.

The development of recommendations for an improvement in distribution relations with due regard for the tasks of increasing the efficiency and intensification of production becomes an urgent research trend. First, it is necessary to intensify the theoretical analysis of the content of the law of distribution according to labor under socialism.

I believe that our scientists should subject the very principle of distribution according to labor to an analysis, taking into consideration the historical experience in the building of socialism in our country and in other countries. What does "according to labor" mean? According to the amount of expenditure of the worker's time and effort, as some scientists believe, or according to the economic evaluation of the results of labor, as others think. There are also other points of view of this problem. This problem is very complex. In order to answer it, it is necessary to even more profoundly study real life and social practice and to develop the appropriate recommendations for the future.

Second, on the basis of a correct examination of the theoretical problems of distribution relations, it will be necessary to develop more actively than before the entire set of practical problems connected with an intensification of the effect of distribution relations on the efficiency of public production. This concerns the system of the population's wages and income, payments and privileges from public consumption funds and redistribution of funds among various population categories.

As follows from the economic strategy of the party, in the investigations of Soviet economists it is necessary to make a more decisive turn to the qualitative aspect of work, a turn reflecting the new objective factors in and conditions of growth of the national economy. During the current five-year plan the increase in final national economic results should outstrip the increase in labor and material expenditures, including capital investments.

In connection with this in fundamental and applied research it is necessary to intensify attention to the resource saving aspects of economic and technical development. An overall, integrated approach is especially important.

The existing methods of determining the efficiency of capital investments do not sufficiently take into consideration the needs for the intensification of the utilization of primary resources and are oriented more toward the utilization of new resources than existing ones, including secondary. A single coefficient of the efficiency of capital investments under conditions when prices are built according to the expenditure principle objectively contributes to the preservation of existing, not always optimal, proportions in the disposition of capital investments.

Of course, a conclusion on the advisability of returning to the differentiated coefficient does not follow from the above stated. On the contrary, this means that it is necessary to increase attention to the fundamental problems of the theory and practice of price formation. It is necessary to more carefully take into account both the socially necessary (socially justified) expenditures of labor and other resources and the possibility of meeting the needs of the national economy.

On the instructions of the USSR State Committee for Science and Technology and the USSR Academy of Sciences a fundamentally new scientific and practical task, that is, the development of a method of measuring the efficiency of economic measures, was included in the research plans for the current five-year plan. This method is to establish a single methodological and methodical basis for an evaluation of capital investments, new equipment and organizational, economic and other management decisions. The significance of such a method is also determined by the fact that it will make it possible to more purposefully engage in work on the elimination of all kinds of losses and a rational utilization of all resources.

As a rule, measures for a reduction in losses require additional capital investments and current expenditures. Therefore, there is a need for a strict quantitative economic evaluation and for a comparison of the measures for the level of efficiency of expenditures on the saving and mobilization of real resources in order to establish the order of measures and to ensure the maximum effect from the allocated funds.

The 26th party congress demanded an improvement in the forms of cost accounting relations and mutual economic interest and responsibility for the fulfillment of planned assignments and contractual obligations between suppliers and consumers, as well as between customers and contractors. This problem is complex and many-sided and has attracted the attention of Soviet economists in many years. Its solution largely depends on the financial policy. In connection with this I would like to recall V. I. Lenin's words: "... All our radical reforms will be doomed to failure if we do not have success in the financial policy" (Vol 36, p 351).

The study of multiaspect financial subjects has not yet received the necessary development in the institutions of the Department of Economics.

Apparently, it is not only a matter of increasing the efficiency of financial levers of cost accounting, but also of developing the concept of financial balance, which includes the determination of optimal limits of the country's payment turnover, combination of financial and credit mechanisms and price formation and development of an effective budgetary and sectorial financial policy.

Study of Advanced Experience

A study and extensive utilization of the advanced experience in the improvement in the economic mechanism accumulated both in our country and in the countries of the socialist camp are the most important conditions for the efficiency of science. During the current five-year plan it will be necessary to continue work on an overall realization in planning and economic activity of the party and government decisions on improving the economic mechanism and strengthening its influence on the efficiency and quality of work.

Rich and, most importantly, diverse experience in efficient management has been accumulated in the country. But the situation with regard to the generalization of this experience is not always satisfactory.

Apparently, it would be useful to especially examine the problem of the forms and methods of organization of the study, generalization and dissemination of advanced experience in economic work. Perhaps it is necessary to discuss this problem together with press and publishing house workers.

The 26th CPSU Congress set the task of carefully studying and more widely utilizing the experience accumulated in the fraternal socialist countries. "We know, for example," said Leonid Il'ich, "how skillfully the work of agricultural cooperatives and enterprises is organized in Hungary and what valuable experience in the rationalization of production and saving of energy, raw materials and supplies there is in the German Democratic Republic. There are many interesting and valuable things in the social security system in Czechoslovakia. Useful forms of agroindustrial cooperation have been found in Bulgaria and a number of other European countries."

A mutual utilization of the experience of the fraternal countries requires an accurate study of all the interrelationships and characteristics of both the economy of a given country and of the Soviet economy. Therefore, together with the workers of planning and economic bodies and with the scientists of the Institute of Economics of the World Socialist System the workers of other economic institutes should take an active part in such investigations. Mutual work with economic scientists from the fraternal socialist countries will help us to solve problems better, to overcome certain difficulties and to develop positive experience.

Soviet economic scientists will do everything that is necessary for a successful implementation of the historical decisions of the 26th CPSU Congress, further strengthening of the country's economic potential and rise in the well-being of the Soviet people.

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INDUSTRIAL DEVELOPMENT AND PERFORMANCE

RENOVATION, RETOOLING ADVOCATED FOR PRODUCTION SECTOR

Moscow POLITICHESKOYE SAMOOBRAZOVANIYE in Russian No 4, Apr 81 pp 21-27

[Article by A. Sidorov and L. Smirnov: "An Important Factor in Increasing the Effectiveness of Production"]

[Text] Our economy is an intricate, multibranch complex in which a major place belongs to construction. Capital investments in the economy in the 10th 5-Year Plan alone amounted to 634 billion rubles. Fixed capital with a valuation of 588 billion rubles was put into operation. More than 1200 large industrial enterprises were established. A large-scale program for the construction of production facilities is also slated for the 11th 5-Year Plan. The overall volume of capital investment is scheduled to grow 12-15 percent. "The new 5-year plan will be a real test for builders," Comrade L. I. Brezhnev stated at the 26th Party Congress. It concentrates effort on the speediest completion and commissioning of those enterprises that can secure the highest increase in output and eliminate bottlenecks. We have already charted such a course and we must follow it without fail."

The most important task of the builders is to use resources effectively, to improve the quality of construction projects, and to put them into operation in a shorter period of time. The party indicates clear and precise ways of reaching this goal. One of the 26th CPSU Congress "Guidelines of Economic and Social Development of the USSR in 1981-1985 and for the Period Up to 1990" is "to concentrate capital investments on the key directions, on priority projects, and especially on the reconstruction and retooling of existing enterprises."

Practice attests to the great economic gain resulting from the reconstruction and retooling of enterprises. This is one of the principal directions in the further development of socialist industry, in the renovation of its fixed productive capital.

Fixed productive capital is a decisive part of the nation's wealth. It presently comprises more than 1.1 trillion rubles. Fixed capital is the foundation of society's material-technical base. The solution of the most important economic and social tasks posed for the 11th 5-Year Plan by the 26th party congress depends in large measure on the scale and degree of utilization of fixed capital.

The planned renovation of fixed productive capital is an objective condition to socialist expanded reproduction. Now that the 26th CPSU Congress has posed the task of making the transition to the predominantly intensive avenue of economic

growth, this objective acquires ever greater importance. The renovation of fixed productive capital is influenced by a number of circumstances. The most decisive of these circumstances is scientific and technical progress which generates continuous progressive change in the development of production. The emergence of new products and new, highly productive means of labor under the influence of scientific and technical progress leads to the rapid obsolescence of the existing implements of labor. The large-scale operation of old, less efficient equipment has a negative impact on the effectiveness of social production and especially on the growth rate of national income. The renovation of fixed capital is also accelerated by the need to improve the product mix of enterprises, to eliminate the disproportions between basic and auxiliary production.

The most important part of fixed productive capital is its active part: machinery and equipment. An increase in the share of the active part in the total value of fixed capital is an indication of progressive changes in its structure. In recent years, throughout industry there has been a certain decline in the share of buildings and structures in the overall value of fixed capital at the same time that the share of machines and equipment has grown (from 34.8 percent in 1970 to 37.9 percent in 1979). This is the trend in the chemical and petrochemical industry, in machine building and metalworking. At the same time, there has been a decrease, albeit negligible, in the share of the active part of fixed capital in the fuel industry, in ferrous metallurgy and in certain other branches.

Fixed productive capital is in actual practice renovated in two ways. The first way is to add to the existing inventory of means of labor additional means of labor which in their parameters do not differ from the existing ones. In such a case, the scale of technical means grows on the old technical and economic base. Today, another way is predominant: the replacement of worn-out and obsolete means of labor by new, more efficient means of labor, which means a considerable growth of labor productivity and more effective production.

The renovation of fixed productive capital naturally requires large-scale capital investment. Today there are three directions of capital investment that reflect various forms of reproduction of fixed productive capital: (1) new construction; (2) expansion of existing enterprises; and (3) reconstruction and retooling of existing enterprises. Each direction has its own unique features which must not be confused or absolutized.

New construction is primarily used to develop certain regions of the nation and to draw new natural resources into production. Thus, the natural resources of the eastern and northern regions of the nation will be developed on a planned, accelerated basis under the 11th 5-Year Plan. However, it must be borne in mind that new construction entails the construction of a production facility over a relatively long period of time. In such a case, it will also be necessary to hire additional manpower, to build a substantial quantity of housing, to build cultural and service facilities, etc. As a result, a large percentage of capital investment in new construction is expended on the construction of production facilities, on the creation of fixed nonproductive capital, on the development of the infrastructure while a lesser percentage is expended on the active part of productive capital (machinery and equipment). The recoupment time of capital investments is substantially protracted as a consequence. The expansion of existing enterprises through the commissioning of new facilities (shops, etc.) has nothing in common with new construction. The result is an increase in production area and in work force.

The reconstruction and retooling of existing enterprises have become a common practice in recent time. The advantage of this approach is that capital is primarily invested in improving the active part of fixed productive capital. However, there are certain distinctions between reconstruction and retooling.

Retooling is a system of measures to raise the technical level of individual units, lines and sectors of production by replacing obsolete machinery and equipment with new, highly efficient models. It is important to emphasize that production area is not expanded or increased in the process and that the work force is even reduced in many instances.

Reconstruction means the total or partial restructuring of production on a new technical base. This may entail not only the replacement of worn-out and obsolete equipment in order to mechanize and automate production but also the construction of new or the expansion of existing auxiliary and service facilities. Disproportions between basic and auxiliary production are thereby eliminated. Reconstruction contributes to the growth of output, to the broadening of the product mix, to the improvement of quality, and to the betterment of the working and living conditions of the enterprise labor force. Reconstruction also frequently changes the enterprises specialty so that it produces new products in the previous production area.

In recent years, an ever increasing percentage of funds have been used for the expansion, reconstruction and technical retooling of existing enterprises. In 1960, 55 percent of all state capital investments in industry were used for this purpose; in 1979 -- 70 percent. The 9th and 10th 5-year plans saw the large-scale expansion, reconstruction and retooling of numerous enterprises and branches of industry. Reconstruction work was carried out on such large enterprises as the Noril'sk Mining and Metallurgical Combine, the Ural'skiy Heavy Machine Building Plant, the Moscow Automotive Plant imeni Likhachev, the Gor'kovskiy Automotive Plant, the Khar'kovskiy and Chelyabinskii tractor plants, the Voskresenskoye "Minudobreniya" Association, the Novomoskovskoye "Azot" Association, and many others.

The experience of construction and industrial enterprises in Moscow, Leningrad, Ivanovo, Baku, Kemerovo, and Sverdlovsk shows the vast reserves that can be brought into play through the planned, systematic reconstruction and retooling of production. Thus in the last 10 years, the Ivanovo textile industry has rebuilt virtually all its mill and has thereby vastly increased its output. The Moscow Oblast party organization has long pursued a policy of renovating old enterprises which are particularly numerous in light industry. Fifty-six plants and factories were re-outfitted under the 10th 5-Year Plan. Among them: the Orekhovskiy and Ozerskiy cotton combines, the Pavlovo-Posadskoye Dressmaking Association, three porcelain plants, the Voskresenskaya Felt Mill, and others. The Moscow Oblast textile industry has been supplied with new equipment to the extent of 80 percent thereby enabling it to reduce its work force by 1.5 percent over a 5-year period. Thirty-two machine building enterprises and a number of plants in the chemical, meat and dairy industry have also undergone reconstruction.

In Sverdlovsk, almost one-third of all capital investments were allocated for the reconstruction of existing production facilities under the Tenth Five-Year Plan.

This factor accounted for half of the increase in industrial output between 1976 and 1979, including 1.5 million tons of steel, 12,000 tons of pipe, etc. The summary economic effect during the five-year period was 653 million rubles as a result of the intensive renovation of existing production. The saving in capital investment was 500 million rubles in comparison with new construction. In the process, the capital investment recoupment time was reduced to 2.5 years.

The reconstruction and technical retooling of existing enterprises become one of the important conditions to converting our economy to intensive development and to the most effective utilization of capital investments. The "Guidelines of Economic and Social Development of the USSR in 1981-1985 and in the Period Up to 1990" state: "Allocate capital investments first and foremost for the reconstruction and retooling of enterprises and for the completion of construction projects in progress. Commence the construction of new enterprises and expand existing enterprises if the requirements of the national economy for a given type of product cannot be secured through the improved use of production capacities with due regard to their reconstruction and technical retooling." The 26th CPSU Congress instructed USSR Gosplan, ministries and departments, and councils of ministers of union republics to draft five-year plan targets in such a way as to allocate more resources for the reconstruction of existing enterprises and to increase their share significantly in the overall volume of capital investments. Reconstruction will achieve its maximum in machine building. This work will make it possible to improve the product mix of the machine building industry, to expand the production of equipment with high unit capacity and of automatic and semiautomatic lines. Reconstruction will for the most part be carried out in the European part of the country.

What advantages do the reconstruction and retooling of enterprises have over new construction? Their main advantage is that they make it possible to increase output with lower capital investments. Let us demonstrate this point on the basis of an example.

In the electrical equipment industry, the capital investments required to secure the same increase in output in 1976-1980 were as follows (expenditures on retooling are taken as 100): reconstruction -- 108.3; expansion of production -- 136.3; and new construction -- 279.8. The explanation for such an appreciable difference is that technical retooling and reconstruction sharply reduce the expenditure of capital investment on the passive part of fixed productive capital (buildings, structures, etc.). Approximately half of the capital investments are expended on the passive part in new construction. The result is a considerable reduction in capital investment per ruble of output, which reduces the recoupment time of capital expenditures. The 26th CPSU Congress emphasized that sums allocated for the reconstruction and retooling of existing enterprises are on the average recouped three times more rapidly than when similar production capacities are the result of new construction.

Rated labor productivity is attained more rapidly at rebuilt enterprises than at expanded and newly built enterprises. Rebuilt enterprises also master the production of new types of products in a shorter period of time. A very important consideration is that the raising of the technical level of production, the mechanization and automation of production (especially the auxiliary sectors) result in the separation of some of the work force which can be employed at new enterprises or other facilities. This is especially important in view of the manpower problem. Today this is practically the only source for filling new jobs.

For example, solely as a result of the technical renovation of factories (mills) and plants the Ivanovo textile industry has succeeded in increasing its output

by 800 million rubles in the last 10 years without increasing production area and work force. Pipe production at the Novotrubnyy Plant in Pervoural'sk (Sverdlovskiy Oblast) rose from 430,000 tons to 680,000 tons a year, i. e., by 250,000 tons, as a result of the reconstruction of a rolling mill. It would take an entire shop, built at a cost of 100 million rubles, to produce such a quantity of seamless thin-walled pipe in a year. There would also be a need for another 1500 workers. Reconstruction, on the other hand, cost only 20.5 million rubles and there was no need for additional manpower. This is not all. Labor productivity increased by 74 percent, the expenditure of metal was reduced by 17,700 tons a year, fuel -- by one-third, and electric power -- by almost one-third. The reconstruction of the Shchekinskoye "Azot" Association (part of a complex of measures to improve the organization of the labor and wages of association personnel) made it possible to release approximately 1600 workers in the last 13 years, to treble output, and to increase labor productivity fourfold.

It must be said that in branches of industry that do not retool their productive capital sufficiently, the manpower shortage worsens, the growth rates of production slacken, and the qualitative indicators of production performance suffer. This, for example, is how things stand at a number of enterprises belonging to the ministries of ferrous metallurgy, the coal industry, and certain other branches. The decisions of the 26th party congress call for the technical retooling of rail transport, enterprises in ferrous metallurgy and other branches of the national economy in the 11th 5-Year Plan.

The growth of the share of capital investments earmarked for reconstruction and the technical retooling of enterprises is characteristic of many branches of industry. However, the sought-for result -- the increase in the share of the active part of fixed productive capital, the higher output-capital ratio, the growth of labor productivity -- is not always attained. Reconstruction frequently proceeds at too slow a pace. It sometimes happens that the equipment that is delivered to replace obsolete equipment is obsolete by the time it is delivered. For example, the reconstruction of the Shchelkovskaya Thin-Cloth Mill imeni Sverdlov by Mosoblstroy Trust No 27 has been in progress 7 years to date. Such examples are, unfortunately, numerous.

Some managers consider reconstruction to be too difficult, laborious and unprofitable. Of course, it is no easy matter to restructure an existing shop. It is much simpler to erect a new shop for which the builders will bear full responsibility. What is more, the collective receives faint rewards for its difficult work. The collective does not, for example, receive additional funds for the expansion of housing. Such funds are only allocated to enterprises engaged in the construction of new facilities. Moreover, the costlier these facilities are, the more funds does the collective receive for its social needs.

Hence some managers are more inclined to build a large, new shop or complex of shops even though they realize that they will have difficulty supplying them with the manpower needed to operate them. The local organs of power also have an interest therein. The expansion of an enterprise and all the more so the construction of an entire plant means a considerable increase in the housing space of a region or city, the construction of modern communications, and the further organization of public services and amenities. They receive nothing of the like from reconstruction no matter how beneficial it may be to the enterprise or the state.

Builders also benefit little from reconstruction. Sometimes they even sustain losses. After all, other things being equal, a considerably smaller volume of

work is performed on more labor-intensive reconstruction projects than on new construction projects. For example, the monthly output of a metal components installer in the Uralt'yazhtrubstroy Trust (Sverdlovskaya Oblast) is usually 4,000 rubles compared with 1,000 rubles in reconstruction work.

In accordance with the decree of the CPSU Central Committee and the USSR Council of Ministers "On Improving Planning and Strengthening the Influence of the Economic Mechanism on Increasing the Effectiveness of Production and Work Quality," the finished project becomes the yardstick by which the builders' work is measured. The given contradiction is eliminated as a result. The system of material rewards for builders performing reconstruction work has also been revised. Thus as of 1 January 1981, correction factors have been introduced for the reconstruction and retooling of existing enterprises. These factors raise the estimated cost of this work compared with the norms for construction and installation work and the norms governing overhead. The wages of managerial personnel of construction and installation organizations primarily engaged in the reconstruction and retooling of existing enterprises have been raised. Higher bonuses have been instituted for the activation of production capacities at reconstruction projects on schedule. All this creates optimal material conditions for accelerating the reconstruction and retooling of enterprises.

But it would be wrong to reduce the entire question to the wages of the builders. It is very important to see to it that the organization of work on the reconstruction and retooling of enterprises would correspond to the role that is presently assigned to the given direction in capital construction. The client unquestionably plays a major part in this work. After all, the client can take a great deal of the work upon himself, e. g., the dismantling of the old equipment, clearing the area for work, removing the old foundations, etc.

However, the most important, pressing and difficult problem continues to be the problem of supplying the builders with means of mechanization and construction-installation equipment adapted for highly efficient and safe operation in a restricted space side by side with existing facilities. In such a case, it is impossible to use the customarily large, unwieldy construction equipment, to fence off the area and to close the area to traffic. This requires compact and highly maneuverable equipment that is both safe and efficient. It is for this reason that the Guideline on the need to expand the manufacture machinery to be used in construction work under conditions of ongoing production is extremely timely. It is important the the appropriate research and design organizations and industrial enterprises develop and produce specialized equipment in a shorter period of time.

Naturally there is also a need for skilled personnel that can use such construction equipment effectively. In our opinion, it is essential to have specialized construction and installation organizations for the reconstruction and retooling of existing enterprises. This will significantly accelerate reconstruction work and increase its effectiveness.

Enterprises and ministries naturally require a certain amount of freedom and independence in the development of their material-technical base and must determine the directions of utilization of capital investments for these purposes. However, as many specialists note, these funds are not always used rationally. Thus, in

the 9th 5-Year Plan, only 20.2 percent of the capital investments earmarked for the development of industry were used for the technical retooling and reconstruction of enterprises; in the 10th 5-Year Plan, this figure was only slightly higher. In other words, the greater part of capital investments is expended on new construction or on the expansion of enterprises. The result is the loss of the gain that could be realized (the economy of capital investments, the reduction of construction time, the reduction of the time required to bring production capacities up to the mark, the reduction of the work force in auxiliary production) from the reconstruction and retooling of enterprises on a broader basis.

Of course, the expansion of production buildings for the purpose of installing highly efficient equipment in order to achieve the more comprehensive utilization of raw materials or the better processing of waste materials constitutes the intensive approach to development which usually does not require the hiring of new personnel. It is another matter when a shop or enterprise is expanded merely in order to increase production. This kind of expansion is undesirable. However, there is no reliable safeguard against it. Ministries, production associations and enterprises have frequently tried to avoid the difficulties associated with the reconstruction and retooling of enterprises and have used resources primarily for new construction or for the extensive expansion of production.

The present rates of reconstruction and retooling of enterprises could be higher if we were to eliminate the still existing shortcomings that hinder the propagation of this promising direction of increasing the effectiveness of social production. One such shortcoming is the lack of coordination of the planning of current production with plans for capital construction and scientific-technical progress. As a result, the production plan sometimes becomes an impediment to the introduction of scientific and technical advances at existing enterprises. It is not always possible to secure a rational correlation between the growth rate of basic production and the scale of introduction of new technology. The elaboration of such a basic part of the plan as the production program is based on mandatory evaluative and capital-forming indicators. However these indicators are little integrated with other sections of the plan including the section devoted to technical progress.

As already noted, reconstruction and retooling measures are a form of reproduction of fixed productive capital and are reflected in the capital construction plan. Therefore it is very important to strive for unity in the planning of production, scientific and technical progress and capital construction. The previously mentioned decree of the CPSU Central Committee and the USSR Council of Ministers on the improvement of the economic mechanism contains the important premise that existing production and new construction must be planned as a unified whole. Accordingly, the 5-year plans will allocate capital investments for the development of branches of material production on the basis of a planned volume of production and services. This ensures the creation of new capacities that are required for the realization of the tasks posed in the 5-year plan. In order to plan production and construction as a unified whole, balances and calculations of the utilization of production capacities and fixed capital will be elaborated as a part of the 5-year plans. Summary plans for the reconstruction and retooling of existing enterprises, inter alia at the expense of the production development fund, will also be developed. Such balances will make it possible to ascertain reserve production capacities and to provide a technical and economic substantiation of the reconstruction of existing enterprises.

All these and other measures to improve the economic mechanism open up broad possibilities to all builders and workers in industry. As the 26th CPSU Congress emphasized, it is the urgent demand of our time to raise the level of all work, to eliminate existing shortcomings, to secure the growth of effectiveness in the construction of production facilities, and to accelerate scientific and technical progress in construction.

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FUNCTIONAL OF ECONOMIC GROWTH DISCUSSED

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[Article by D. Shimon, Budapest, and V. S. Samovol, Moscow: "The Functional of Economic Growth"]

[Text] 1. Introduction

Contemporary economic development is an extremely complex process. An adequate representation of this process requires special mathematical apparatus. Many attempts have been made in economic research to work out the tools for this purpose. The classical approach to the issues relies on constructing so-called production functions; many works by Soviet and foreign authors have been devoted to this approach (in particular [1-10]). At the same time, despite the large amount of such research, the problem cannot be considered finally resolved. Specifically, there must be further study of the very basic issue of adequate representation of scientific-technical progress and of the complex interactions among the primary factors of contemporary economic growth.

In production functions of the Cobb-Douglas type, economic development (in particular, growth of national income Y) in a certain segment of time is essentially determined by the boundary states of the growth factors (live labor L and production capital K), specifically

$$\ln[Y(t_2)/Y(t_1)] = \alpha \ln[L(t_2)/L(t_1)] + \beta \ln[K(t_2)/K(t_1)],$$

in other words, it is represented in the form of a linear combination of changes in growth factors. It is assumed here that the elasticity coefficients (α , β) are constant.

Later, of course, production functions with variable elasticities for growth factors were proposed. In addition, time was included in the production functions in order to consider the effect of scientific-technical progress. But time in the best case describes the results of the operation of scientific-technical progress, and the question of identification of this factor remains open. The key question in determining the elasticities of the factors is, in our opinion, the question of the variables on which these elasticities depend and identification of these dependencies. Formulated in this way, the problem was not resolved in works which considered the variable elasticities.

Based on the above, a multifaceted consideration of the three interrelated problems seems natural: identifying the group of primary growth factors, determining the elasticities of these factors, and identifying the influence of scientific-technical progress on economic development. This, of course, requires quite extensive information covering, in particular, economic growth at different levels and under very different conditions. Only in this case is it possible to disclose and identify the functional dependencies that adequately describe the primary trends of contemporary economic development.

This paper uses information on the economic development of the CEMA countries and their principal sectors in the period 1950-1975. This permits a comprehensive review of a very broad spectrum of states of economic objects and their development over time. The research conducted made it possible to obtain definite results on the full range of problems stated above.

Analysis demonstrated that the principal (primary) factors of contemporary economic development, in addition to the traditional ones (live labor and productive capital), are highly skilled labor L_1 and the consumption of working people C . A determination of their elasticity requires the formation of so-called secondary factors that express the degree to which the other principal factors are available to live labor. The magnitudes of the elasticities of the primary growth factors L , K , L_1 , and C are expressed in the form of functions that depend on the levels and rates of change in the secondary factors. Thus, growth in national income is essentially defined by the growth, level, and rate of change of the principal factors.

According to the proposed approach, scientific-technical progress depends, generally speaking, on change in the means available to live labor. In this connection it is possible to distinguish two types of scientific-technical progress. The first is related to growth in the capital-labor ratio, while the second is linked to change in the other secondary factors.

Economic development in a certain time interval is determined by the whole trajectory of changes in growth factors, which makes it necessary to use the mathematical concept of the functional to reflect growth processes.* The authors, in constructing the functional of economic growth, began from the idea that differences in economic development should essentially be explained by differences in the trajectories of growth factors. This hypothesis requires that the functional be invariant relative to the countries, sectors, and periods of development under consideration and that the elasticities of growth factors be determined in the form of functions that are expressed through their independent variables by means of unique constant parameters.

We present below the general form of the functional constructed, review the problem of classifying types of economic growth and trends toward change in the maximum efficiency of the principal economic growth factors, analyze certain

*These indicators are also called the elasticities of national income according to particular factors.

indicators of development of the Soviet economy, and in conclusion point out further possibilities for using the results obtained.

2. General Form of the Functional

Let us introduce the following symbols: Y — volume of national income produced; t — time; K — volume of fixed productive capital; L — number of persons employed in the sectors of material production; L_1 — number of specialists with higher education in the sectors of material production and scientific research positions; C — volume of consumption of the people working in the sectors of material production. Y and the primary factors K , L , L_1 , and C depend on t . The secondary factors

$$\begin{aligned} F_1 &= f(n_1 K/L), \\ F_2 &= f(n_2 L_1/L), \\ F_3 &= f(n_3 C/L), \text{ where } f(x) = \begin{cases} \ln x, & x \geq 1, \\ 0, & 0 \leq x < 1; \end{cases} \end{aligned}$$

n_1 , n_2 , and n_3 are norming coefficients, with N_1 and N_2 depending on the system of prices selected. In the particular case the prices (in rubles) used were for the early 1970's and $n_1 = n_3 = 0.01$. The coefficient n_2 was determined to be equal to 1,000. For these values of the coefficients, the economic states where $F_1 = F_2 = F_3 = 0$ may be considered initial in the sense that under these conditions secondary factors do not exercise a significant influence on economic growth. We should note that the contemporary level of secondary factors in the economies of the CEMA countries greatly exceeds the level of the initial state.

Empirically, the functional was determined in the following form

$$P_{uu} = \int_0^u \left(\sum_{i=1}^3 S_i dF_i \right), \quad (1)$$

$$P_{uu} = \ln \frac{Y}{L}(t_u), \quad S_i = 1 - \exp(-aF_i),$$

$$S_1 = bF_1 \exp[d_1 F_1 + d_2 F_2 + d_3 R_1(1 + d_4 R_1)],$$

$$S_2 = cF_2 \exp[d_1 F_1 + d_2 F_2 + d_3 R_2(1 + d_4 R_2)],$$

$$R_i = \ln(1 + F_i), \quad R_i = \frac{dR_i}{dt}, \quad 1 \leq i \leq 3.$$

As the result of calculations based on information for the CEMA countries, these values were obtained for the parameters of the functional: $a = -0.08$; $b = 0.8$; $c = 2.7$; $d_1 = -0.2$; $d_2 = -0.8$; $d_3 = -22$; $d_4 = 14.8$.

Statistical data from several sectors was used to determine these seven parameters. Specifically, we considered dynamic series for industry, construction, transportation and communications, and for trade in eight socialist countries (Bulgaria, Hungary, East Germany, Mongolia, Poland, Romania, the Soviet Union, and Czechoslovakia) by five-year periods for the years 1950-1975. The essential feature of the dynamized variation of cross-analysis used is that "dynamic" series were formed and each of them included data relative to a concrete indicator for all the countries and sectors under consideration in the study period. Thus, there were more than 150 observations for each indicator, which is fully adequate to determine these parameters.

The least squares method was used for calculation. Parameters were found by successive approximations and the essential mathematical-statistical characteristics were determined at each step. Essential mathematical-statistical estimates were analyzed at the same time. In particular, the following were calculated: the coefficient of multiple determination; the t-statistic of regression coefficients; the F-statistic for testing the hypothesis of the existence of a relationship between dependent and independent variables; and, the Darbin-Watson coefficient for analyzing the autocorrelation of residual quantities.

When describing the results obtained relative to the mathematical-statistical characteristics, we should note first of all that the final coefficient of multiple determination (refined) was 0.94. The values of the t-statistic showed that the probabilities of a zero hypothesis in determination of the parameters at no point exceeded 0.1 and in a large majority of the cases were less than 0.01. Testing by the F-criterion demonstrates the considerable significance of both individual factors and the aggregate of all factors, and in all cases the values of the F-statistic indicated that the probability of the hypothesis of the non-existence of a statistical relationship should not exceed 0.1; it was mostly less than 0.01. Calculations of the Darbin-Watson statistic indicated the absence of autocorrelation among residuals.

From the point of view of using the functional to analyze economic growth, it is more convenient to transform expression (1) as follows

$$Y_{int} = \int_{t_1}^{t_2} [S_L d \ln L + S_K d \ln K + S_L d \ln L_t + S_C d \ln C], \quad (2)$$

where

$$Y_{int} = \ln[Y(t_2)/Y(t_1)], \quad S_L = 1 - \sum_{i=1}^3 S_i, \quad S_K = S_1, \quad S_L = S_2, \quad S_C = S_3.$$

3. Classifications of Types of Economic Growth

Economic growth can be classified by different characteristics. One of the most important is classification by sources of growth. In this case it is customary to distinguish extensive and intensive sources of growth. For example, in [1] intensity is defined depending on the magnitude of the total elasticity of production factors. Let us consider this question on the basis of the functional that has been constructed.

First let us observe that the quantities $S_L(K, L_1, C)$ are coefficients of the maximum effectiveness of the production factors. Now let us note that the total elasticity in the model constructed is equal to one. Therefore, it is impossible to determine the contribution of intensive growth factors based on the magnitude of the total elasticity of the factors. Of course, this is related to the difference in the range of growth factors identified in the present article and in the studies of other authors (for example in [1]). Here we have adopted as a starting point a representation in which the degree of intensive growth means the proportion of growth in the productivity of public labor in growth of national income. This approach is quite well-known; what is new is the possible factorization of intensive growth into components by basic factors and identifying its sources in this way. It is simple to obtain the following formula for factorization of growth and labor productivity from expression (1)

$$d \ln \frac{Y}{L} = S_K d \ln K + S_{L_1} d \ln L_1 + S_C d \ln C - (S_K + S_{L_1} + S_C) d \ln L \quad (3)$$

It can be seen from (3) that the effect of factors K , L_1 , and C relates to the intensive type of growth, while growth in live labor reduces the degree of intensity depending on the coefficients of maximum efficiency S_K , S_{L_1} , and S_C . Beginning from (3) it is possible to distinguish three basic types of growth: intensive, extensive, and deintensive. Intensive growth is characterized by the fact that $d \ln(Y/L) > 0$. This condition is fulfilled if, for example, $dF_1 > 0$, $1 \leq i \leq 3$. In the case of extensive growth $d \ln(Y/L) = 0$, which is possible in particular where $dF_1 = 0$, $1 \leq i \leq 3$. Finally, deintensive growth is observed when $d \ln(Y/L) < 0$, for example where $dF_1 < 0$, $1 \leq i \leq 3$. It is always possible on the basis of (3) to make a concrete analysis of the contribution of particular factors to the different types of economic growth.

Now let us consider the case where $F_2 = \text{const}$, $F_3 = \text{const}$. In this situation it follows from (1) that

$$d \ln Y = (1 - S_1) d \ln L + S_1 d \ln K.$$

Thus, we observe here a certain analogy with the well-known Cobb-Douglas production function $Y = AK^\alpha L^{1-\alpha}$. For a full analogy it is necessary to assume further that $F_1 = \text{const}$. Then it is obvious that

$$\frac{Y(t_1)}{Y(t_0)} = \left(\frac{L(t_1)}{L(t_0)} \right)^{1-\alpha} \left(\frac{K(t_1)}{K(t_0)} \right)^{\alpha}.$$

Therefore, the functional is reduced to a Cobb-Douglas function where all secondary factors are unchanged. As was indicated above, this situation corresponds to the extensive type of growth. We should observe that

$$\lim_{F_1 \rightarrow \infty} S_1 = 1, \quad \lim_{F_1 \rightarrow \infty} S_j = 0, \quad j=2, 3$$

(considering that $\alpha_j \geq 0$, $1 \leq i \leq 3$). Thus, at the extreme we obtain the pure intensive type of growth, and the functional relationship (1) then has the simple form $d \ln Y = d \ln K$.

It can be seen from this that production functions with constant factor elasticities can describe economic growth only in very special cases or for quite

short time segments (when it may be assumed conditionally that $F_1 \neq \text{const.}$, 14163). This indicates that production function with constant factor elasticities have a relatively limited sphere of application.

4. Tendencies Toward Changes in the Coefficients of Maximum Efficiency of Economic Growth Factors

It can be seen from Section 3, and also from the concrete analysis made in Section 5, that the coefficients of maximum efficiency of growth factors are actually variable quantities. Changes in them are governed by definite rules. Let us try to briefly characterize the rules and compare the results obtained with widespread views on this question.

It has been argued that the coefficient of maximum effectiveness of production fixed capital declines when the economy is saturated with productive capital, which is expressed in growth in the proportion of production capital investment in final product (for example, see work [1]). Our studies lead to the opposite conclusion.

Three basic situations are possible. The first has a constant level of the capital-labor ratio. In this case the coefficient of maximum efficiency of capital does not change. If the levels of the remaining secondary factors are constant in this case, extensive growth occurs, as pointed out above. In the second case, in which there is growth in the capital-labor ratio, the coefficient of maximum effectiveness of capital also rises. In this case, if the remaining secondary factors do not diminish, there is intensive growth. Finally, when the coefficient of maximum efficiency of capital declines along with a drop in the capital-labor ratio, there will be deintensive growth on the condition that the remaining secondary factors do not grow. In the general case, the coefficient of efficiency of capital is an increasing function of the capital-labor ratio and varies in the range from 0 to 1. This means that saturation of the economy with capital investment (increase in the savings norm) causes a rise, not a decline, in the coefficient of maximum efficiency of capital if the amount of live labor grows more slowly than productive capital.

Let us consider the reason for this. It is usually concluded from the fact that the technical level is given for any moment in time that the efficiency of capital investment declines as investment grows. But this fails to consider the fact that the "given technical level" at any moment in time in a contemporary economy is a spectrum of possible technologies, and from them the most efficient may be realized with a growth in capital investment. In practice, therefore, that threshold beyond which a decline in the efficiency of capital investment would follow is not reached in most cases.

As for the indicator of maximum efficiency* of capital (distinguished from the coefficient of maximum efficiency), it means the absolute growth in national income

*These indicators are also called the elasticities of national income according to particular factors.

where only fixed capital grows and the other factors remain unchanged:
 $dY = S_K(Y/K)dK$. Thus, the maximum efficiency of capital ($S_K Y/K$) is the product of the coefficient of maximum efficiency times the output-capital ratio. It is clear that growth in maximum efficiency itself does not follow simply from a rising trend in the coefficient S_K . The results of concrete analysis of this indicator illustrate nonetheless that in most cases the maximum efficiency of capital has this kind of trend. We will discuss this question in greater detail in the next section, analyzing the development of Soviet industry.

Now let us consider the coefficients of maximum efficiency of the other growth factors which are in reality directly linked to live labor, either with its quantity (L) or quality (L_1, C). It is expedient to analyze the combined effect of all these factors.

In the simplest case with one-percent growth in L, L_1 , and C (and K constant), growth in national income is expressed as follows

$$\Delta \ln Y = S_L + S_{L_1} + S_C - 1 - S_K.$$

The resulting quantity is positive and, as a diminishing function of the capital-labor ratio, varies in the range from 1 to 0. Let us note that in the general case the coefficient of maximum efficiency of live labor S_L is equal to the quantity $1 - S_K - S_{L_1} - S_C$, which may also take negative values. This is because an increase in just the number of employed persons lowers the level of all secondary factors, which has a negative effect which may exceed the positive results on the increase in the amount of live labor.

To characterize the coefficients of maximum efficiency of the factors related to the quality of labor (L_1, C), it is necessary to point out that they depend not on the levels of secondary factors but also on their rates of change. Let us first analyze the effect of changes in the capital-labor ratio on these coefficients.

We should observe that these factors make a contribution to economic growth on the condition $P_1 > 0$, that is, when then capital-labor ratio exceeds a certain minimum level. In this case further growth in the capital-labor ratio has a dual effect on the coefficients S_{L_1} and S_C ; on the one hand it leads to an increase through growth in the opportunities to improve production processes, while on the other hand it has a negative impact connected to growing expenditures that accompany each such improvement. Thus, the total impact depends on the ratio of its constituent parts: where the values of P_1 are relatively small it is positive, but when they are large it is negative. The impact of P_1 on the coefficients S_{L_1} and S_C is to an extent similar. The difference is that the transition from a positive overall effect to a negative one appears to occur at a fairly low level of P_1 . Available information only permitted identification and approximation of the negative effect of the level of P_1 on the coefficients S_{L_1} and S_C . As for the negative effect of the quantities R_1 and 14143 on the coefficients S_{L_1} and S_C , it appears to be related to the adaptation needs of the economy given changes in the levels of secondary factors.

5. Some Results of Analysis of Economic Growth

In this section we will characterize the results of an analysis of the characteristics of current economic growth. This analysis was made for the CEMA countries and the basic sectors of their economies, but here we will limit ourselves to a consideration of only some results for Soviet industry. Specifically, we will deal with three sets of questions: the rates and factors of economic growth; the maximum efficiency of the growth factors; and, factor analysis of labor productivity and the output-capital ratio. We will review figures on the development of USSR industry in the years 1950-1978. Table 1 below presents the results of a comparison of actual and calculated growth rates.

Table 1. Average Annual Growth in Volume of National Income in USSR Industry, in percentage*

Periods	Percentage		Difference, a-b
	a, Actual	b, Calculated**	
1955-1950	14.5	12.7	1.8
1960-1955	9.7	11.7	-2.0
1965-1960	9.0	9.3	-0.3
1970-1965	9.8	9.6	0.2
1975-1970	7.8	7.4	0.4
1978-1975	5.7	6.2	-0.5
1960-1950	12.1	12.2	-0.1
1970-1960	9.4	9.5	-0.1
1978-1970	7.0	6.0	0.1
1978-1960	8.3	8.3	0.0
1978-1950	9.7	9.8	-0.1
1975-1950	10.1	10.1	0.0

* The raw data here and in subsequent tables were compiled on the basis of the books "Narodnoye Khozyaystvo SSSR" [The USSR National Economy] and "Statisticheskii Yezhagodnik Stran-Chlenov SEV" [Statistical Yearbook of the CEMA Countries].

** on the basis of five-year (and three-year) data

The development of Soviet industry in this period proceeded at a high rate. At the same time, quite significant differences are observed for particular time segments. As was noted above, the parameters of the functional were determined on the basis of data on the development of all the CEMA countries, including other sectors in addition to industry. Nonetheless, the model gives a fairly accurate description of the actual growth of USSR industry. It can be observed that the accuracy of the approximation tends to improve with an increase in the length of time considered. Specifically, the figure is more accurate for the 10-year intervals than for five-year intervals, and for the entire period the actual and calculated results are practically the same. We should also note

that the parameters of the functional were determined on the basis of an analysis of the years 1950-1975, whereas Table 1 contains calculated data for 1976-1978 as well, which essentially means the model was used for forecasting.

Table 2 below gives figures on the relative contribution of particular factors to growth in the volume of national income.

Table 2. The Role of the Primary Factors in Growth in the Volume of National Income (for USSR Industry)

No	Factors	Indicators*	Periods			
			1951-1960	1961-1975	1971-1978	1961-1978
1	$S_K \Delta \ln K$	a	0.024	0.026	0.024	0.025
		b	20.0	26.0	35.8	26.0
2	$S_{L_1} \Delta \ln L_1$	a	0.027	0.030	0.011	0.020
		b	23.5	23.0	10.4	21.5
3	$S_C \Delta \ln C$	a	0.072	0.054	0.032	0.054
		b	62.6	50.3	47.8	58.1
4	$(1-S_K) \Delta \ln L$	a	0.000	0.025	0.011	0.023
		b	20.1	27.5	16.4	24.7
5	$\Delta \ln Y_p - S_K \Delta \ln K$	a	0.001	0.005	0.043	0.008
		b	79.1	71.1	61.2	73.1
6	$\Delta \ln Y_p$	a	0.115	0.091	0.067	0.093
		b	100	100	100	100

* a -- average annual growth;

$$b = (\alpha / \Delta \ln Y_p) 100, \Delta \ln Y_p = S_K \Delta \ln K + S_L \Delta \ln L + S_{L_1} \Delta \ln L_1 + S_C \Delta \ln C.$$

Because the actual and calculated values of growth in the volume of national income in these periods practically coincide (see Table 1), what is considered here is just the component of calculated growth which consists entirely of the contributions of the primary factors.

The figures in the table show that the influence of increase in capital on the rate of economic growth has a rising trend. As for live labor, we must distinguish the impact of its quantitative and qualitative changes. The result of the quantitative changes is represented in the fourth line of Table 2 and has a decreasing trend, which is related above all to the decrease in the rate of growth of live labor. The contribution of qualitative changes in live labor was a larger component of economic growth for the entire period under consideration, which can be seen from the figures for factors L_1 and C . At the same time, this component has a tendency to decrease in connection with the growing role of capital. This relates to both of its constituent parts ($S_{L_1} \Delta \ln L_1$, $S_C \Delta \ln C$). Nonetheless, these results show the relatively greater role of highly skilled labor, which is ultimately linked to the effect of those expenditures which society makes for the development of science and higher education. The overall (quantitative and qualitative) effect of live labor is represented in the fifth line

of the table. As can be seen from the figures given, the percentage of this effect is generally close to the proportion of consumption in national income.*

Moving on to the second set of questions, let us first give the coefficients of maximum efficiency of the growth factors (see Table 3 below).

Table 3. Coefficients of Maximum Efficiency and Growth Factors (for USSR Industry, Based on Five-Year or Three-Year Data)

Periods	Coefficients			
	S_K	S_{L_1}	S_C	$1 - S_K$
1951-1955	0.216	0.376	0.734	0.784
1956-1960	0.237	0.301	0.676	0.763
1961-1965	0.238	0.248	0.690	0.762
1966-1970	0.277	0.300	0.582	0.723
1971-1975	0.294	0.177	0.529	0.706
1976-1978	0.300	0.167	0.563	0.699
1951-1960	0.227	0.280	0.705	0.777
1961-1970	0.268	0.224	0.741	0.732
1971-1978	0.302	0.172	0.547	0.698

Significant growth in the coefficient of maximum efficiency of capital occurred during this period owing to rapid growth in the capital-labor ratio of USSR industry. At the same time, the coefficients of maximum efficiency of live labor remained at a fairly high level. Table 4 below shows how all these changes affected the indicators of maximum efficiency of growth factors.

We must note first the stable growth in the indicators of maximum efficiency of capital and live labor (as a whole). The maximum efficiency of live labor grew especially fast (averaging 5-6 percent a year). The same indicator for capital rose about one percent a year. The latter result followed from, on the one hand, significant growth in the coefficient of maximum efficiency (S_K) and, on the other hand, change in the output-capital ratio. Although the second component was negative in most cases, it was not sufficiently negative to completely nullify the positive effect from growth in the coefficient S_K .

The maximum efficiencies of the qualitative factors of live labor do not have a rising tendency, and factor C does not have a clearly marked tendency to decrease. With respect to factor L_1 it is worth observing that the decline in its maximum efficiency beginning in the second half of the 1950's was fairly slow (an average of one percent a year) and, as already observed, the results of the contribution of this factor significantly exceed expenditures for its reproduction.

* Needless to say, these figures should not be interpreted from the standpoint of the so-called "distributive" method (see [1], p 211). For example, the proportion of factor L is not directly linked to the wage rate, and so on.

Table 4. Change in the Maximum Efficiency of Growth Factors
(for USSR Industry)

Periods	Indicators			
	$s_K \frac{Y}{K}$	$(1-s_K) \frac{Y}{L}$	$s_L \frac{Y}{L}$	$s_C \frac{Y}{C}$
1951-1955	1	1	1	1
1956-1960				
1951-1955	1.13	1.42	0.56	0.08
1961-1965				
1951-1955	1.13	1.70	0.63	1.30
1966-1970				
1951-1955	1.17	2.32	0.51	0.05
1971-1975				
1951-1955	1.25	3.09	0.46	0.00
1976-1978				
1951-1955	1.25	3.72	0.43	0.00

Moving on to an analysis of the productivity of public labor, we will consider the factors that cause growth in this indicator in USSR industry (see Table 5 below).

Table 5. Growth Factors of the Productivity of Public Labor
(Y/L) in USSR Industry

Factors	Indicators*	1951-1970	1961-1970	1971-1978	1951-1978
$S_K \Delta F_1$	a	0.015	0.017	0.019	0.017
	b	20.0	20.8	37.3	27.4
$S_L \Delta F_2$	a	0.016	0.013	0.009	0.013
	b	21.3	22.8	17.6	21.0
$S_C \Delta F_3$	a	0.045	0.028	0.023	0.033
	b	60.0	49.1	45.1	53.2
Others	a	-0.001	-0.001	0.0	-0.001
	b	-1.3	-1.7	0.0	-1.6
Total($\Delta \ln \frac{Y}{L}$)	a	0.075	0.057	0.051	0.062
	b	100	100	100	100

* a -- average annual growth; b = $a100/\Delta \ln(Y/L)$.

From these data it can easily be seen that the decisive factor in growth in the productivity of public labor is scientific-technical progress. As mentioned earlier, two types of scientific-technical progress are distinguished: one is linked to productive capital, and the other to live labor. In Table 5 the quantities $S_K \Delta F_1$ correspond to the former, while $S_L \Delta F_2 + S_C \Delta F_3$ corresponds to the latter. The figures illustrate the rising tendency of the first form of scientific-technical progress, although its share of growth in labor productivity is still lower than that of the second form. Table 5 shows that the slight decline in the rate of growth of productivity is linked entirely to the second form of scientific-technical progress.

The results of analysis of change in the output-capital ratio of USSR industry are of some interest (see Table 6 below).

Table 6. Factors of Change in Output-Capital Ratio $\Delta Y/K$ in USSR Industry

Factors	Indica- tors*	1951-1960	1961-1970	1971-1978	1951-1978
$(S_n-1)\Delta F_1$	a	-0.053	-0.047	-0.045	-0.040
	b	-7.0	6.7	3.5	12.3
$S_{L_1}\Delta F_2$	a	0.016	0.013	0.009	0.013
	b	2.3	-0.8	-0.7	-3.3
$S_{C_1}\Delta F_3$	a	0.045	0.028	0.023	0.033
	b	6.4	-4.0	-1.8	-8.3
Other	a	-0.001	-0.001	0.0	-0.001
	b	-0.1	0.1	0.0	0.3
Total $(\Delta \ln \frac{Y}{K})$	a	0.007	-0.007	-0.013	-0.004
	b	1	1	1	1

* a -- average annual change; b = $a/\Delta \ln(Y/K)$.

This indicator had a decreasing tendency in this time period. According to our results, this is basically because the coefficient of maximum efficiency of capital at the present time is substantially less than one, and the positive contribution of the second type of scientific-technical progress in most cases could not entirely overcome this negative effect.

The results presented in this section are in large part illustrative and are given for the purpose of demonstrating certain possibilities of using the functional we constructed. At the same time, they create certain conditions for testing the basic propositions stated above.

In conclusion it would be useful to briefly describe the basic areas of use of this functional.

One of the primary opportunities to use it, of course, is for analyzing and forecasting economic development on the level of particular countries and sectors and within particular economic regions. In this case the analysis and forecast of the impact of particular factors under conditions of the scientific-technical revolution is especially interesting. The functional of economic growth can be used in the development of economic outlines and plan alternatives. In this connection we may point out that it would be useful to construct more comprehensive models to develop solutions to optimization problems of economic policy and structural development.

Planned use of such economic tools as prices, rates of exchange, and the like has an important part in management of a socialist economy. A correct evaluation of economic growth factors is very important for planned price formation. The real magnitudes of these estimations and their tendencies to change can be determined on the basis of our functional.

The efficiency of management of a socialist economy is ultimately determined by the level of knowledge of the laws of economic development. Our proposed functional may promote a deeper understanding of these laws and in this respect serve as one of the starting points for the development of a scientifically substantiated theory of economic growth.

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